

## § 86.1306–07

## 40 CFR Ch. I (7–1–04 Edition)

(§§ 86.1306 through 86.1314); calibration methods and frequencies (§§ 86.1316 through 86.1326); test procedures (§§ 86.1327 through 86.1341 and §§ 86.1360 through 86.1380); calculation formulas (§§ 86.1342 and 86.1343); and data requirements (§ 86.1344).

[65 FR 59958, Oct. 6, 2000]

### § 86.1306–07 Equipment required and specifications; overview.

Section 86.1306–07 includes text that specifies requirements that differ from § 86.1306–96. Where a paragraph in § 86.1306–96 is identical and applicable to § 86.1306–07, this may be indicated by specifying the corresponding paragraph and the statement “[Reserved]. For guidance see § 86.1306–96.”.

(a) and (b) [Reserved]. For guidance see § 86.1306–96.

(c)(1) Upon request, the Administrator may allow a manufacturer to use some of the test equipment allowed for model year 2006 and earlier engines instead of the test equipment required for model year 2007 and later engines, provided that good engineering judgment indicates that it would not adversely affect determination of compliance with the applicable emission standards of this part.

(2) A manufacturer may use the test equipment required for model year 2007 and later engines for earlier model year engines, provided that good engineering judgment indicates that it would not adversely affect determination of compliance with the applicable emission standards of this part.

(d) Approval of alternate test system.  
(1) If on the basis of the information described in paragraph (d)(5) of this section, the Administrator determines that an alternate test system would consistently and reliably produce emission test results that are at least equivalent to the results produced using the test systems described in this subpart, he/she shall approve the alternate system for optional use instead of the test systems described in this subpart.

(2) Any person may submit an application for approval of an alternate test system.

(3) In approving an alternate test system, the Administrator may approve it

for general use, or may approve it conditionally.

(4) The Administrator may revoke the approval on the basis of new information that indicates that the alternate test system is not equivalent. However, revocation of approval must allow manufacturers sufficient lead-time to change the test system to an approved system. In determining the amount of lead-time that is required, the Administrator will consider relevant factors such as:

(i) The ease with which the test system can be converted to an approved system.

(ii) The degree to which the alternate system affects the measured emission rates.

(iii) Any relevant conditions included in the approval.

(5) The application for approval must include:

(i) *An explanation of the theoretical basis of the alternate system.* This technical description should explain why the detection principle of the alternate system would provide equivalent results to the detection principle of the prescribed system for the full range of emission properties being measured. This description may include equations, figures, and references. For example, a NO<sub>x</sub> measurement application should theoretically relate the alternate detection principle to the chemiluminescent detection principle of detecting nitric oxide for a typical range of NO to NO<sub>2</sub> ratios. A PM measurement application should explain the principle(s) by which the alternate system quantifies PM mass independent of PM composition, and how it is impacted by semi-volatile and volatile species= phase distributions. For any proportioning or integrating system, the application should compare the alternate system's theoretical response to the prescribed system's response.

(ii) *A technical description of the alternate system.* This section shall detail all of the hardware and software included in the alternate system. Dimensioned drawings, flow-charts, schematics, and component specifications shall be included. Any data manipulation (*i.e.* calculations) that the system performs shall be presented in this section.

(iii) *A description of the procedures used to operate the system including the level of training that an operator must have to achieve acceptable results.* This section of the application shall describe all of the installation, calibration, operation, and maintenance procedures in a step-by-step format. Note that empirical calibration with respect to another prescribed or approved measurement system is not acceptable. Calibration should be performed with NIST traceable standards, or equivalent national standards. Diagrams, schematics, and other graphics may be used to enhance the description.

(iv) *A comparison of results from the alternate system and from the prescribed system (or other system approved by the Administrator).* The two systems must be calibrated independently to NIST traceable standards or equivalent national standards for this comparison. While other statistical analyses may be acceptable, it is recommended that the comparison be based on a minimum of 7 collocated and simultaneous tests. This comparison shall be performed over the “hot-start” portion of the FTP test cycle. If the comparison is paired, it must demonstrate that the alternate system passes a two-sided, paired t-test described in this paragraph. If the test is unpaired, it must demonstrate that the alternate system passes a two-sided, unpaired t-test described in this paragraph. Other statistical criteria may be set by the Administrator. The average of these tests for the reference system must return results less than or equal to the applicable emissions standard. The t-test is performed as follows, where “n” equals the number of tests:

(A) Calculate the average of the alternate system results; this is  $A_{avg}$ .

(B) Calculate the average of the results of the system to which the alternate system was referenced; this is  $R_{avg}$ .

(C) For an unpaired comparison, calculate the “n-1” standard deviation for the alternate and reference averages; these are  $A_{sd}$  and  $R_{sd}$  respectively.  $A_{sd}$  must be less than or equal to  $R_{sd}$ . If  $A_{sd}$  is greater than  $R_{sd}$ , the Administrator will not approve the application.

(D) For an unpaired comparison, calculate the t-value:

$$t_{unpaired} = (A_{avg} - R_{avg}) / ((A_{sd}^2 + R_{sd}^2) / n)^{1/2}$$

(E) For a paired comparison, calculate the “n-1” standard deviation (squared) of the differences,  $d_i$ , between the paired results, where “i” represents the  $i^{th}$  test of n number of tests:

$$S_D^2 = (Sd_i^2 - ((Sd_i)^2/n)) / (n-1)$$

(F) (1) For a paired comparison, calculate the t-value:

$$t_{paired} = (A_{avg} - R_{avg}) / (S_D^2/n)^{1/2}$$

(2) The absolute value of t must be less than the critical t value,  $t_{crit}$  at a 90% confidence interval for “n-1” degrees of freedom. The following table lists 90% confidence interval  $t_{crit}$  values for n-1 degrees of freedom:

90% Confidence interval critical t values vs. n-1 degrees of freedom for a two-sided, paired t-test	
n - 1	$t_{crit}$
6 .....	1.94
7 .....	1.89
8 .....	1.86
9 .....	1.83
10 .....	1.81
11 .....	1.80
12 .....	1.78
13 .....	1.77
14 .....	1.76
15 .....	1.75
16 .....	1.75
17 .....	1.74
18 .....	1.73
19 .....	1.73
20 .....	1.72

[66 FR 5168, Jan. 18, 2001]

#### § 86.1306-90 Equipment required and specifications; overview.

(a) *Exhaust emission tests.* All engines subject to this subpart are tested for exhaust emissions. Petroleum-fueled, natural gas-fueled, liquefied petroleum gas-fueled and methanol-fueled, Otto-cycle and diesel engines are tested identically with the exception of the systems used to measure hydrocarbon, nitrogen oxide, methanol, formaldehyde and particulate; petroleum-fueled diesel engines require a heated, continuous hydrocarbon detector and a continuous nitrogen oxide detector (§ 86.1310); methanol-fueled engines require a heated hydrocarbon detector, a methanol detector and a formaldehyde detector; either a heated or a non-heated continuous hydrocarbon detector may be used with natural gas-fueled